UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/547,844	09/02/2005	Satoshi Sugahara	125209	2196

25944 7590 10/08/2008

OLIFF & BERRIDGE, PLC
P.O. BOX 320850
ALEXANDRIA, VA 22320-4850

EXAMINER	
SANDVIK, BENJAMIN P	

ART UNIT	PAPER NUMBER
2826	

MAIL DATE	DELIVERY MODE
10/08/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/547,844	SUGAHARA ET AL.	
	Examiner	Art Unit	
	Ben P. Sandvik	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 June 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5-17,40-60,62-65,67-81 and 83-86* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-3,5-17,40-60,62-65,67-71,80,81 and 83-86* is/are allowed.

6)☒ Claim(s) *72-79* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 72 and 75 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 72, 75, 77-79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kirczenow (U.S. Patent #6355953), in view of Hsu et al (U.S. Patent #6753562), further in view of Lee et al (U.S. PG Pub #2004/0041217).

With respect to **claim 72**, Kirczenow teaches a source and a drain (Fig. 5, 54/56) formed with ferromagnetic semiconductors (see Col 13-14, for example CoS_2); a semiconductor layer that is provided associated with the source and the drain, and has a channel of the first conduction type formed therein (Fig. 5, 52); and a gate electrode that is formed as opposed to the semiconductor layer (Fig. 5, 61), wherein the ferromagnetic semiconductors in the source and the drain are directly contacted with the semiconductor channel; but does not teach that the ferromagnetic semiconductors are of a first conduction type, i.e. the same conduction type as the semiconductor layer. Hsu teaches ferromagnetic

semiconductors that can be doped to the same conduction type as a semiconductor material (Col 6 Ln 52-58). It would have been obvious to one of ordinary skill in the art at the time the invention was made to doped the ferromagnetic semiconductors of Kirczenow as taught by Hsu in order to achieve the predictable result of enhancing the spin injection efficiency (Col 6 Ln 40).

Furthermore, Kirczenow does not teach that the ferromagnetic material is directly contacted with side surface of the channel. Lee teaches a spin device (Fig. 11, and paragraph 59) having a ferroelectric material source/drain that is directly contacted with side surfaces of the channel (Fig. 11, 105). It would have been obvious to one of ordinary skill in the art at the time the invention was made to arrange the source/drain ferroelectric materials of Kirczenow as taught by Lee in order to achieve the predictable result of injection spin-polarized carriers into a channel of the device.

With respect to **claim 75**, Kirczenow teaches a source and a drain (Fig. 5, 54/56) formed with ferromagnetic semiconductors (see Col 13-14, for example CoS_2); a semiconductor layer that is provided associated with the source and the drain, and has a channel of the first conduction type formed therein (Fig. 5, 52); and a gate electrode that is formed as opposed to the semiconductor layer (Fig. 5, 61), wherein the ferromagnetic semiconductors in the source and the drain are directly contacted with the semiconductor channel; but does not teach that the ferromagnetic semiconductors have a different conduction type from the semiconductor layer. Hsu teaches ferromagnetic semiconductors that can be

doped to a different conduction type than a semiconductor material (Col 6 Ln 52-58). It would have been obvious to one of ordinary skill in the art at the time the invention was made to doped the ferromagnetic semiconductors of Kirczenow as taught by Hsu in order to achieve the predictable result of forming various pn junctions in the device.

Furthermore, Kirczenow does not teach that the ferromagnetic material is directly contacted with side surface of the channel. Lee teaches a spin device (Fig. 11, and paragraph 59) having a ferroelectric material source/drain that is directly contacted with side surfaces of the channel (Fig. 11, 105). It would have been obvious to one of ordinary skill in the art at the time the invention was made to arrange the source/drain ferroelectric materials of Kirczenow as taught by Lee in order to achieve the predictable result of injection spin-polarized carriers into a channel of the device.

With respect to **claim 77**, Kirczenow does not teach that when the relative magnetization of the ferromagnetic drain with respect to the ferromagnetic source is antiparallel magnetization, the drain current is lower than the drain current in a case of parallel magnetization. Hsu teaches that when the relative magnetization of the ferromagnetic drain with respect to the ferromagnetic source is antiparallel magnetization, the drain current is lower than the drain current in a case of parallel magnetization (Col 9 Ln 3-8). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the device of Kirczenow so that when the relative magnetization of the ferromagnetic drain with

respect to the ferromagnetic source is antiparallel magnetization, the drain current is lower than the drain current in a case of parallel magnetization as taught by Hsu in order to achieve the predictable result of operating the device to provide spin-polarized carriers.

With respect to **claim 78**, Kirczenow does not teach that the trans-conductance can be controlled in accordance with the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source. Hsu teaches that the trans-conductance can be controlled in accordance with the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source (Col 2 Ln 61-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the device of Kirczenow so that the trans-conductance can be controlled in accordance with the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source as taught by Hsu in order to achieve the predictable result of operating the device to provide spin-polarized carriers.

With respect to **claim 79**, Kirczenow does not teach using the transistor, information being stored in accordance with the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source, the information stored in the transistor being detected based on the transconductance of the transistor depending on the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source. Hsu teaches using the transistor, information being stored in accordance with the

relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source, the information stored in the transistor being detected based on the transconductance of the transistor depending on the relative magnetization direction of the ferromagnetic drain with respect to the ferromagnetic source (Col 2 Ln 61-65). It would have been obvious to one of ordinary skill in the art at the time the invention was made to store information in the device of Kirczenow as taught by Hsu in order to use the device to store memory data.

Claim 73 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kirczenow, Hsu, and Lee, in view of Ohno et al (U.S. PG Pub #2001/0031547).

With respect to **claim 73**, Kirczenow does not teach that the semiconductor layer is formed with an undoped semiconductor or an intrinsic semiconductor. Ohno teaches that the semiconductor layer is formed with an undoped semiconductor or an intrinsic semiconductor (Paragraph 28, GaSb). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use undoped semiconductors in the transistors of Kirczenow as taught by Ohno in order to achieve the predictable result of forming a MOSFET.

Claims 74 and 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kirczenow, Hsu, and Lee, in view of Johnson.

With respect to **claims 74 and 76**, Kirczenow does not teach that the channel length is equal to or shorter than the mean free path associated with carrier energy relaxation. Johnson teaches that the channel length is equal to or shorter than the mean free path associated with carrier energy relaxation (Col 10 Ln 60-63). It would have been obvious to one of ordinary skill in the art at the time the invention was made to arrange the channel length as taught by Johnson in order to control the resistance between the source and drain.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben P. Sandvik whose telephone number is (571) 272-8446. The examiner can normally be reached on Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on 571-272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/B. P. S./
Examiner, Art Unit 2826

/Evan Pert/
Primary Examiner, Art Unit 2826